Copy for Dale Bryson (~Sep 80)

IN-20-09 1

FIELD INVESTIGATION REPORT (FINAL) CONCERNING DISTRIBUTION OF LEAD (Pb) AT U.S. SMELTING LEAD REFINING CO. BY HAZARDOUS WASTE INVESTIGATIONS SECTION EEI BRANCH OF S&A DIVISION - REGION V

REPORT DATE: August 27, 1980
REPORT AUTHOR: Dr. Robert J. Gnaedinger, Jr.

1 IDENTIFICATION OF ORGANIZATIONS

1.1 U.S. Smelting Lead Refining Company
East Chicago, Indiana

2 DATES ON SITE

April 8-9, 1980 - Tuesday and Wednesday

3 PARTICIPANTS

3.1 U.S. Smelting
Mr. R. Derek Steels, Plant Engineer

3.2 East Chicago Air Quality Control Agency
Mr. Ali Khan

3.3 U.S. EPA - Region V
Dr. Robert J. Gnaedinger, Jr., Physical Scientist
Mr. Ron Lillich, Biologist
Ms. Erin Moran, Geologist

4 PURPOSE OF SITE INVESTIGATION

The primary purposes of the investigation were to confirm the findings of an earlier non-sampling inspection by Mr. Robert L. Stone and Ms. Elissa Brown of the Air and Hazardous Materials Division, to obtain samples for chemical analysis in order to determine the extent to which lead was moving off from the site, and to make a photographic record of site conditions.

5 SUMMARY OF INFORMATION OBTAINED

History of site, observations, photographs, and copies of some records were obtained. In addition, samples of soil, water and waste were obtained from on site as well as from the adjacent Grand Calumet River, both above and below the site, and from the Indiana Harbor Canal at 151st.

6 LIST OF FIGURES

FIGURE 1 Photographs 2-5, clockwise from upper left; from center of lead smelting slag fill area; Tuesday, April 8, 1980.

2. View of lead slag pile "No. 1" (from East side of pile); Sample 1 from the pile; Ali Khan of E. Chicago Air Quality on left and Ron J. Lillich of U.S. EPA, Region V, on right. Photographed by Robert J. Gnaedinger, Jr. of the U.S. EPA, Region V; 1:16 p.m.

Reference #5

3. View to NNE of lead slag, of drums and of plant beyond on left and in center; from East side of pile 1; 1:17 p.m.

4. View to NNW of lead slag and of plant beyond; from East side of pile 1; 1:19 p.m.

5. View to SW of edge of slag fill in marsh reeds; from West side of slag fill; 1:21 p.m.

FIGURE 2 Photographs 7, 8 and 9, clockwise from upper left; Tuesday, April 8, 1980:

7. View to NW from West side of lead slag fill area; empty drums lie S of the concrete shipping/receiving dock; tree in center of picture is at the approximate location of the exit of a storm drain which extends North beneath dock and beneath buildings beyond. A pool in the reeds in the foreground is the source of water specimens referred to as "effluent" in reports submitted by U.S. Smelting to the State of Indiana. Our Sample 17 came from this pool. 1:27 p.m.

8. View to N from West side of lead slag fill area; plant is in background; U.S. EPA personnel are in yellow protective jackets in the left background; Ali Khan of E. Chicago Air Quality is on the right. No smoke from the tall stack was visible during our inspection on April 8-9, 1980. 1:28 p.m.

9. View to NNW from shipping/receiving dock. Processed lead ingots are on dock ready for shipment. Sample 2 came from 6" vertical pipe at bottom of manhole; a lower storm drain pipe reportedly is present below the manhole being connected to the base of the manhole via the 6" vertical pipe. This lower drain reportedly leads into the marsh at the South edge of the concrete dock area. 1:39 p.m.

FIGURE 3 Photographs 10, 11 and 12, clockwise from upper left; Tuesday, April 8, 1980:

10. Looking South towards pussy willows in bloom; from South side of EW portion of the U.S. Smelting Canal. 2:00 p.m.

11. Looking Northwest from Southeast corner of intersection of the Grand Calumet River (on left) and the U.S. Smelting Canal(on right) River flows towards upper right; direction of flow in the canal is uncertain. 2:08 p.m.

12. Looking North across U.S. Smelting Canal at its mouth. Ron Lillich is shown with water sampler just used for collecting Sample 3 at the mouth. Muskrat surfaced at edge of Canal, then quickly reversed his direction, underwater.

FIGURE 4 Photographs 13, 14, 15 and 16, clockwise from upper left; Tuesday, April 8, 1980:

13. Looking South from land path along the South side of U.S. Smelting Canal. Slag, firebrick and barrels are remains from long past dumping practices. (Plant reportedly has been operating on this site since 1906.)

Empty shotgun shells lying on ground; condition suggests recent shooting. It is also reported that young people do some hanging out in this area of the site. 2:16 p.m.

14. Looking NE across marsh, reeds and water towards plant from land path along South side of Canal; shot from location shown in Photograph 13. 2:20 p.m.

15. Oil slick on Canal surface near plant; surface flow of Canal appears to be towards the plant (upper right) from the Grand Canal at this point and time. 2:25 p.m.

16. Location from which Sample 5 was taken; this was a very wet soil sample from the marsh on the NW side of the Canal. Marsh water is evident (gray-blue patches). Location is near the point at which the Canal changes direction. Sample 4 was obtained from a similar location on the SE side of the Canal.

FIGURE 5 Photographs 19, 18 and 24, clockwise from upper left; Tuesday, April 8, 1980 and Wednesday, April 9, 1980:

19. Looking NW from the North side of the engineering office building, after rainstorm. Piles of cinders, slag and scrap steel. 3:17 p.m., April 8, 1980.

18. Small pool in marsh land just South of machine shop and waste piles South of shop. Sample #8 was taken from this pool. Bright red-orange iron oxide stain covers center of bottom of pool. 3:40 p.m., April 8, 1980.

24. View towards ESE from the head waters of the U.S. Smelting Canal; from West side of Canal. 4:45 p.m., April 9, 1980.

FIGURE 6 Photographs 17, 20, 6 and 1, clockwise from upper left; Tuesday, April 8, 1980:

17. Looking E from location Southwest of Machine Shop. Ground surface is slag; pile of air filtration bags from exhaust from smelting furnaces at left center. 3:17 p.m.

20. Looking W from NS road just W of Main Office. Rinsed battery casings, from used batteries, being discharged to dump area for future pickup. 3:55 p.m.

6. Looking SE from slag-filling site towards boundary of slag and reed-covered marshland. Railroad and Kennedy Avenue in background. Kennedy Avenue bridge across Grand Calumet River is under re-construction.

1. Looking S along storm water discharge ditch, which runs parallel to and West of railroad. Photo taken near North end of ditch. Sample #18 taken at this location on April 9, 1980.

FIGURE 7 Photographs 21, 22 and 23, clockwise from upper left; Wednesday, April 9, 1980:

21. Looking NNW from railroad bridge at Grand Calumet River Crossing, adjacent to Kennedy Avenue. U.S. Smelting plant in background with lead slag fill margin with water evident. ~ 1:05 p.m.

22. View of railroad bridge looking SW from Kennedy Avenue, where new automobile bridge is presently under construction. Samples #9 and #10 were taken from the center of the railroad span. ~ 1:10 p.m.

23. View of 151st Street bridge where it crosses the Indiana Harbor Canal. View is towards SE from NW quadrant. U.S. Van on the bridge. 2:50 p.m.

FIGURE 8 Results of Analyses of Water Samples for the General Chemical Parameters: Specific Conductance, Sulfate, Chloride, pH and Fluoride.

FIGURE 9 Results of Analyses of Samples for total Lead, Arsenic and Antimony.

FIGURE 10 Map of Site, from U.S.G.S. 7-1/2 Minute Topographic, Gary and Vicinity, Indiana.

7 LIST OF SAMPLES

Samples S01 through S08 were taken on April 8, 1980; Samples S09 through S19 were taken on April 9, 1980.

SAMPLE NUMBER	TIME OF COLLECTION	IDENTIFICATION
sed 80VG04S01	1:15 p.m.	[redacted], Pile #1
sed 80VG04S02	1:50 p.m.	[redacted] on Receiving Dock
water 80VG04S03	2:30 p.m.	Water from U.S. Smelting Canal at Junction with with the Grand Calumet River
sed 80VG04S04	2:45 p.m.	[redacted] from Marsh on SE Side of Canal
sed 80VG04S05	2:45 p.m.	[redacted] from Marsh on NW Side of Canal
soil 80VG04S06	3:00 p.m.	[redacted] from 5-6 locations around the buildings of the site.
sed 80VG04S07	3:30 p.m.	[redacted] from Big House
water 80VG04S08	3:40 p.m.	Water Sample from small pond SW of Engineering Office Building
water 80VG04S09	12:15 p.m.	Water Sample from Grand Calumet River at Kennedy Avenue Bridge at ~ 1 ft. depth
sed 80VG04S10	1:00 p.m.	[redacted] from Grand Calumet River at Kennedy Avenue Bridge

5

SAMPLE NUMBER	TIME OF COLLECTION	IDENTIFICATION
water 80VG04S11	2:30 p.m.	Water Sample from Indiana Harbor Canal at 151st Bridge at ~ 1 ft. depth
water 80VG04S12	2:45 p.m.	Bottom Water Sample from Indiana Harbor Canal at 151st bridge
water 80VG04S13	3:15 p.m.	Water Sample from Grand Calumet River at Indianapolis Boulevard at ~ 1 ft. depth
pod 80VG04S14	3:35 p.m.	[redacted] from Grand Calumet River at Indianapolis Boulevard
water 80VG04S15	4:30 p.m.	"Influent"; Water Sample from W side of Canal at N End
sed 80VG04S16	4:30 p.m.	[redacted] from W side of Canal at N End
water 80VG04S17	4:40 p.m.	"Effluent"; Water Sample from Marsh, E of Drum Pile and S of Receiving Dock
water 80VG04S18	4:45 p.m.	Water Sample from Drainage Ditch on East, N End
water 80VG04S19	3:05 p.m.	Water Sample from Cold Water Tap in Engineering Building
water	20 (Blank)	

8 RESULTS OF THE CHEMICAL ANALYSES OF SAMPLES

8.1 Analyses of Water Samples for the General Chemical Parameters; Specific Conductance, Sulfate, Chloride, pH and Fluoride.

Seven (7) water samples were tested for the above parameters. The results of the testing are tabulated in Figure 8.

If we consider, for the moment, that the surface water from the Grand Calumet River at Kennedy Avenue (where it flows West adjacent to the site) is our norm, then we can see that all of the other samples have higher concentrations of sulfate, chloride and fluoride, and, consistently, higher values for specific electrical conductance.

The most contaminated off-site water is that obtained from the Grand Calumet River at Indianapolis Boulevard. This water was flowing Eastward towards its juncture with the East branch of the Grand Calumet at the West end of this site. There the two flows combine to deliver their water to the Indiana Harbor Canal and thence to Lake Michigan.

However, the U.S. Smelting site appears to be making significant contributions of chloride, sulfate and fluoride ions to the Grand Calumet River and to be adding acids, as well, as evidenced by the low pH values and the high chloride, sulfate and fluoride values found in the "Effluent (S17) and in the East Drainage Ditch (S18).

The high sulfates are most probably arising from the used lead storage batteries which are reprocessed on site; these contain sulfuric acid solutions which are reportedly neutralized on site using limestone. The resulting calcium sulfate is rather insoluble and is normally removed, off-site, by Industrial Disposal Company. It is clear, however, that the neutralization process was ineffectively operating at the time of our inspection.

We believe that the high fluorides occur because of their presence in materials brought on site for recovery. Chloride ion, as well, appears to be contributed by on site processes. The chloride concentration found in the Grand Calumet at Indianapolis Boulevard is, of course, much larger than any of the on site concentrations.

8.2 Analyses of Samples for Total Lead, Arsenic and Antimony

These results are given in Figures 9-1 and 9-2. As expected, the lead concentrations varied over a tremendous range, i.e. from 29.00% in the flue dust to less than 2 ppb in water from the cold water tap. The lowest value in the environmental samples was 27 ppb in the "Influent" water from the North end of the U.S. Smelting Canal. It might be noted that none of the values for lead concentration in the "Influent", as analyzed by U.S. Smelting Lead Refining Company, the parent company, were as low as this value; the lowest in the report copies from U.S. Smelting Lead Refining Company in our possession was 60 ppb lead.

Though we have questioned the value for the lead concentration in the "Influent," the concentration of 3400 ppb in the "Effluent" suggests that lead is flowing outward from the plant area by this route. It may in fact be so that it does not reach the Grand Calumet River, but is retained on the marshland, which is owned by U.S. Smelting.

Similarly, the lead concentration at the North end of the East drainage ditch was rather high at 1800 ppb, though no flow in this ditch was obvious. Rather more striking in this case was the very large arsenic concentration of 5800 ppb; this could be attributed to the very low pH found in the water at this location; highly acid conditions increase the solubilities of most metallic oxides.

We have no data indicating the rate at which lead from the slag pile is moving into the marsh nor indicating the rate of lead movement from the marsh into the Grand Calumet River.

In this connection we should re-note that Robert L. Stone's map indicates that the present slag heap does not extend into the flood plain, though it still appears that slag is being dumped into the marshland. We have checked neither elevations nor flood plains with Corps of Engineers maps in this regard, though the presence of marsh water adjacent to the slag would suggest that the flood plain does include portions of the marsh now covered with slag.

The analysis of Sample S06 is rather significant; a lead concentration of 16% is indicated. The sample is a composite of surface samples taken at various locations around the operating portions of the site; Stone had requested that we obtain such a composite. We suspicion that it is related to the gray pall that covered the roadways and the immediately adjacent ground. It appeared to us as if lead flue dust had been casually hauled around in a front end loader, for example, with excessive loss by spill or by wind. This is a point of major concern to us since it represents one of the more hazardous aspects of this site.

Substantial information is present on these data sheets; the expected ubiquitous distribution of lead was found. We compared the results we obtained for River and Canal samples with data from monthly samplings during 1978 by the Division of Water Pollution Control, Indiana State Board of Health. There was reasonable agreement between their results and ours. Only one location was precisely common to their investigations and ours -- the Grand Calumet River at Kennedy Avenue. Good agreement was found between the two sets for specific conductance, sulfate, chloride and pH; however, the lead concentration found in our sample was ~2 times the maximum value found in 1978 by Indiana.

9 CONCLUDING COMMENTS

9.1 The Company is in contact with and is operating with the knowledge of the State of Indiana, Stream Pollution Control Board.

9.2 The Company admittedly does have problems with their flue dust collection system, resulting in occasional failures.

9.3 The dust along the internal roadways has a very large lead concentration. Its presence and the processes and handling methods leading to its presence represent serious hazards, especially to plant personnel. Plant personnel all wear dust masks around their necks, but it is not clear how frequently they are in proper use around their noses and mouths.

9.4 The Company appears to have problems in achieving full and effective neutralization of the sulfuric acid waste.

9.5 We are concerned that excessive amounts of fluoride may be moving off the site into the Grand Calumet River.

9.6 We are concerned that excessive amounts of lead and arsenic may be moving off the site into the Grand Calumet River.

9.7 We are concerned about the health of present employees; perhaps all should be tested for the lead content in their blood.

9.8 We are seriously concerned about the location of this site and about its contribution of lead to the environment, even though it has been in operation since 1906.

9.9 We are seriously concerned about the high lead levels in the Grand Calumet River bottoms. Accidental spills into the River of materials with a high affinity for lead could solubilize large amounts of lead from the bottoms into the river water.

9.10 We are seriously concerned about the high concentration of lead found in the West branch of the Grand Calumet River and in the Indiana Harbor Canal at 151st Street. In spite of the relatively low values (20 ppb) for lead reported for the Indiana Harbor Canal near its outflow into Lake Michigan, we suspect that a steady outpouring of lead into Lake Michigan is occurring.

4/7 8/80 GY

ENVIRONMENTAL PROTECTION AGENCY, REGION V BASIC DATA FORM

92

DIVISION / BRANCH SSA/EEIB

Sampling Date 8-9 / APR / 80 (Day Month Year) Lab Arrival Date 10 APR 80 (Day Month Year) Analysis Due Date

D. U. NUMBER DATA SET EEIB 263

Account No. Study U.S. Smelting

T.G.

Parameter No.				00095	00945	00940	00956	00410		
CDO Sample Log Number				Specific Conductance	Sulfate	Chloride	Total Silica as SiO_2	Alkalinity as $CaCO_3$	pH	FLUORIDE
Units				µmhos/cm at 25°	mg/l	mg/l	mg/l	mg/l		mg/l
80VG04S09	80VG04	S09	Grand Calumet / Kennedy / 1 ft	480	50	36			7.0	.41
80VG04S11	80VG04	S11	INDIANA HARBOR CAN. 151 St / 1 ft	570	58	61			7.1	.48
80VG04S12	80VG04	S12	INDIANA HAR. CANAL 151 St / BOTTOM WATER	570	58	60			7.1	,
80VG04S13	80VG04	S13	Grand Calumet / Indianapolis Blvd	1900	173	390			7.1	1.0
80VG04S15	80VG04	S15	"Influent" / U.S. SMELTING CANAL	980	189	77			6.7	3.1
80VG04S17	80VG04	S17	"Effluent" / Marsh at Sewer	2600	1,410	71			5.9	7.2
80VG04S18	80VG04	S18	Drainage Ditch on East Side	7800	5,000	210			2.3	77.
				4-14-80	4/17/80	4/17/80			4-14-80	4-17

Code 1 - 7 day [illegible] [illegible] analysis [illegible] .029 mg [illegible]

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FIGURE 8

008

[illegible] & [illegible]

ENVIRONMENTAL PROTECTION AGENCY, REGION V BASIC DATA FORM

DIVISION / BRANCH S&A/EE&B — Sampling Date 8-9 Apr 80 (Day / Month / Year) — Lab Arrival Date 10 Apr 80 (Day / Month / Year) — Analysis Due Date ____ (Day / Mo)

D. U. NUMBER DATA SET EEIB 263 — 6 May 80 — Account No. ____ — Study U.S. Smelting

Parameter	01105	01002			01034	01037	01042	01045	01051	01055	
CDO Sample Log Number	Total Aluminum	Total Arsenic			Total Antimony	Total Cobalt	Total Copper	Total Iron	Total Lead	Total Manganese	
DVG04 Units	μg/l	μg/l			μg/l	μg/l	μg/l	μg/l	μg/l	μg/l	
DVG04S01		751 mg/kg	SLAG		393 mg/kg				80000 mg/kg		SEDIMENT
DVG04S02		insufficient sample	STORM	DRAIN	insufficient sample				insufficient sample		SEDIMENT
DVG04S03		3.6 ppb	Grand Calumet / U.S. Smelt. Canal		K2 ppb				52 ppb		WATER
DVG04S04		45 mg/kg	Marsh SE of	Soil Canal	126 mg/kg				2300 mg/kg		SEDIMENT
DVG04S05		2400 mg/kg	Marsh NW of	Soil Canal	87.2 mg/kg				970 mg/kg		SEDIMENT
DVG04S06		1600 mg/kg	SURFACE COMPOSITE	SOIL	1220 mg/kg				160000 mg/kg		SEDIMENT
DVG04S07		6300 mg/kg	FLUE DUST		1810 mg/kg				290000 mg/kg		SEDIMENT
DVG04S08		47 ppb	SMALL	POND	850 ppb				350 ppb		WATER
DVG04S09		42 ppb	Grand Calumet / Kennedy / 1 ft		2.7 ppb				98 ppb		WATER
DVG04S10		55 mg/kg	"	Bottom	K.4 mg/kg				790 mg/kg		SEDIMENT
DVG04D10		46 mg/kg	Duplicate		2.4 mg/kg				900 mg/kg		SEDIMENT
DVG04S11		5.9 ppb	Indiana Harbor / 151st / 1 ft		K2 ppb				187 ppb		WATER
DVG04S12		4.0 ppb	"	Bottom Water	K2 ppb				157 ppb		WATER
DVG04S13		11 ppb	Grand Calumet / Indianapolis / 1 ft		3.0 ppb				290 ppb		WATER
DVG04S14		41 mg/kg	"	Bottom	3.5 mg/kg				860 mg/kg		SEDIMENT
DVG04D14		41 mg/kg	Duplicate		3.2 mg/kg				800 mg/kg		SEDIMENT
DVG04S15	—	270 ppb	"Influent"		70.5 ppb				27 ppb		WATER
DVG04S16		1700 mg/kg	U.S. Smelting Canal / Bottom		393 mg/kg				8500 mg/kg		SEDIMENT
DVG04D16		1700 mg/kg	Duplicate		437 mg/kg				13000 mg/kg		SEDIMENT
		Ra 5/6/80			Ra 5/6/80				Ra 5/6/80		

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FIGURE 9-1

Note; As, Sb and Pb may all be present in high concentrations

U.S. Government Printing Office: 1973-550-487/2114

ENVIRONMENTAL PROTECTION AGENCY, REGION V BASIC DATA FORM

DIVISION / BRANCH [illegible] Sampling Date 8 Apr 80 (Day Month Year) Lab Arrival Date 10 Apr 80 (Day Month Year) Analysis Due Date ____ (Day Month Year)

D. U. NUMBER ____ [illegible] Account No. ____ Study U.S. Smelting

CDC Sample Log Number	Total Aluminum	Total Arsenic			01034 Total Antimony	01037 Total Cobalt	01042 Total Copper	01045 Total Iron	01051 Total Lead	01055 Total Manganese	
Units	µg/l	µg/l			µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
[illegible]4517	—	280 ppb	"Effluent"		196 ppb				3400 ppb		WATER
[illegible]4519		5800 ppb	E. Drainage Ditch		815 ppb				1800 ppb		WATER
[illegible]04519		3.6 ppb	Cold Water Tap		K2 ppb				K2 ppb		WATER
[illegible]R20		3.0 ppb	Blank		K2 ppb				K2 ppb		WATER
		Ka 5/6/80							Ka 5/6/80		

[illegible]

FIGURE 9-2

NOTE: As, Sb and Pb may all be present in high concentrations

U.S. Government Printing Office: 1979-630-457/2110

FIELD INVESTIGATION REPORT
Robert Gnaedinger
August 27, 1980

			Arsenic (mg/kg)	Antimony (mg/kg)	Lead (mg/kg)
GENERAL					
sed	S01	slag heap	751	3.93	50,000
sed	S07	flue dust	6,300	1,810	290,000
sed	S02	storm drain	–	–	–
sed	S06	comp surf. soil	1,600	1220	160,000
water	S18	water from drainage ditch on E, N end	5800 µg/l	815 µg/l	1,800 µg/l
water	S19	faucet in Eng Bldg.	3.6 µg/l	K2 µg/l	K2 µg/l
water	S08	Pond SW of Eng Bldg	47 µg/l	850 µg/l	350 µg/l
MARSH					
sed	S04	Soil from marsh on SE side of canal	45	126	2,300
sed	S05	Soil from marsh on NW side of canal	2400	87.2	990
water	S17 effluent	Water sample from marsh, S of rec. dock	280 µg/l	196 µg/l	3,400 µg/l
CANAL					
water	S15 northern	W side of canal at N end	270 µg/l	70.5 µg/l	27 µg/l
sed	S16	W side of canal at N end	1,700/1,700	393/437	8,500/13,000
water	S03	Canal at junction w Grand Cal. River	3.6 µg/l	K2 µg/l	52 µg/l
RIVER					
water	S09 upstream	From Gr. Cal. River at Kennedy Ave Bridge	4.2 µg/l	2.7 µg/l	98 µg/l
sed	S10		55/46	K.4/2.4	710/900
water	S11 downstream	From Ind. Harbor Canal at 151st St. Bridge	5.9 µg/l	K2 µg/l	187 µg/l
water	S12		4.0 µg/l	K2 µg/l	157 µg/l
water	S13	From Gr. Cal. River at Indianapolis Boulevard	11 µg/l	3.0 µg/l	290 µg/l
sed	S14		41/41	3.5/3.2	860/800